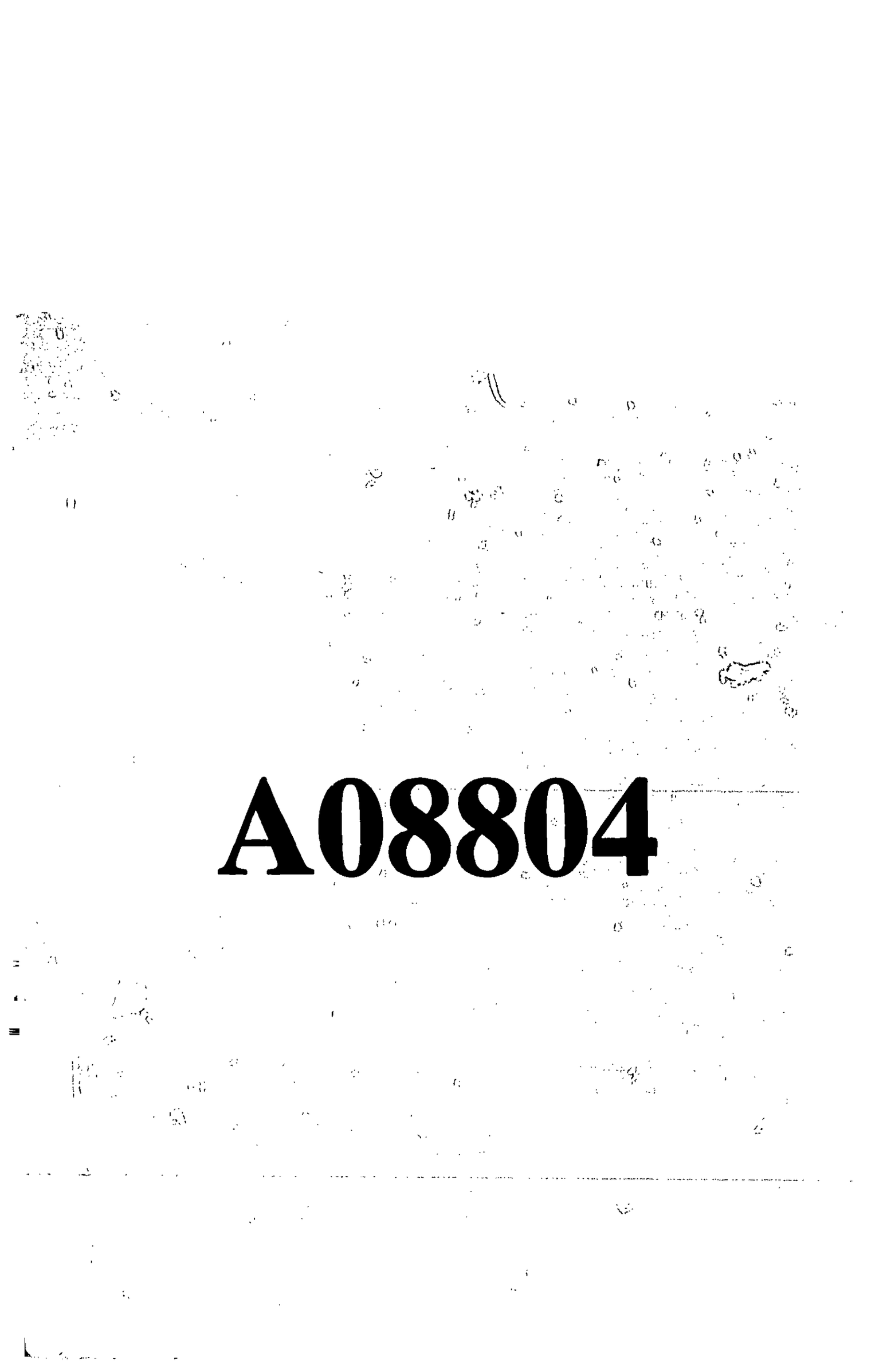
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# VULNERABILITY OF WILLOW PTARMIGAN TO HUNTING

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# VULNERABILITY OF WILLOW PTARMIGAN TO HUNTING

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*Abstract:* The percentage of juvenile willow ptarmigan (*Lagopus lagopus*) was determined for a population of birds in southeastern Newfoundland in August and September for 7 years, and in the harvest in October for 8 years. Juvenile birds comprised 72 percent of the August population, 74 percent of the kill in the first week of hunting, 72 percent of the harvest in the second week, and 67 percent of the kill in the third and fourth weeks of October. The proportion of late-hatched young (July 8–August 10) was greater in the kill than in the pre-season population. The cause of this disproportional representation may have been due to differential vulnerability of early- and late-hatched young.

## INTRODUCTION

The percentage of juvenile birds in the harvest has been shown to decline as the hunting season progressed for pheasants (*Phasianus colchicus*), bobwhite quail (*Colinus virginianus*), ruffed grouse (*Bonasa umbellus*), capercaillie (*Tetrao urogallus*), and black grouse (*Lyrurus tetrix*) (Kimball 1948, Eberhardt and Blouch 1955, Bennett 1951, Dorney and Kabat 1960, Helminen 1963). The view of most of these authors was that the decline in the ratio of young to adults in the kill reflected a greater vulnerability of young birds than adults to the gun. However, in most of these studies, the juvenile:adult composition of the population prior to the hunting season was not known. This paper compares the percentage of juvenile willow ptarmigan harvested during 1955–64, with the pre-season percentages of juvenile birds in the population.

## METHODS

The pre-season percentage of young birds in the population on two hunting barrens on the Avalon Peninsula in southeastern Newfoundland was determined each year by direct counts in August and September in 1955 and 1957–64. Field workers used setter dogs to locate broods. All single adults, adult pairs with and without young, and young that could fly were counted. A special effort was made to flush all the

Table 1. Percentage of juvenile ptarmigan in the population in August and September.

| Year Censused | Birds in Sample | Percent Juveniles ± 95 Percent C.L. |
|---|---|---|
| 1955 | 190 | 69 ± 7 |
| 1957 | 90 | 77 ± 8 |
| 1958 | 585 | 70 ± 3 |
| 1959 | 902 | 70 ± 3 |
| 1960 | 292 | 74 ± 5 |
| 1961 | 880 | 68 ± 3 |
| 1962 | 871 | 64 ± 3 |
| 1963 | 904 | 71 ± 3 |
| 1964 | 340 | 69 ± 4 |
| Total and Mean | 5260 | 72 |

Table 2. Shrinkage in percentage of juveniles in the harvest throughout the 4-week season.

| October Hunting Season | Percentage of Juvenile Birds by Hunting Weeks in October | | | | Correlation Coefficient (r) Percent Young on Days Hunting Previous |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | |
| 1955 | 75 | 68 | 61 | 60 | −0.983* |
| 1956 | 73 | 74 | 70 | 69 | −0.870 |
| 1957 | 79 | 70 | 76 | 72 | −0.973* |
| 1958 | 78 | 75 | 81 | 74 | −0.279 |
| 1960 | 70 | 74 | 71 | 63 | −0.903* |
| 1961 | 76 | 74 | 67 | 62 | −0.953* |
| 1963 | 65 | 66 | 57 | 66 | +0.037 |
| 1964 | 70 | 64 | 52 | 67 | −0.298 |
| Means | 74 | 72 | 67 | 67 | −0.929 |

* $P < 0.05$.

birds in the broods. The field crew did not move on until the setter dogs had thoroughly investigated the flushing locale.

Hatching dates were plotted for the years 1961 to 1964 by determining the age of the chicks in captured broods (Bergerud et al. 1963:705). Captured chicks that were released were wing-tagged.

The ptarmigan hunting season opened on the first Monday in October in all years except 1962 and closed on October 31 except in 1962. In 1962, the season opened on September 17 and continued well into November in some areas (Bergerud and Huxter 1969). The daily bag limit was 6 birds in all years except 1962. A bag of 8 birds was permitted in 1962.

The age of hunter-killed birds was determined by wing plumage (Bergerud et al. 1963). Late-hatched (July 8–August 10) birds could be separated from early-hatched (June 13–July 7) birds by the presence of juvenile primary 8. In the years 1955–60, cooperative hunters forwarded wings by mail. In the period 1961–1964, mandatory check stations were maintained throughout the season at the entrances of the hunting barrens where the age-composition counts were made in August. All birds examined were aged, sexed, weighed, and checked for wing tags.

## FINDINGS

The mean percentage of young birds in the pre-season population during 1955–64 was 72 percent (Table 1). The mean percentage of juvenile birds in the kill of the first week of hunting was 74 percent, the second week 72 percent, and in the third and fourth weeks, 67 percent (Table 2). The percent decline in juveniles was significant ($P < 0.05$) in 4 of the 8 years (Table 2).

Tag returns of young birds showed that late-hatched young were more common in the harvest than their abundance in the population would warrant (Table 3). This comparison seemed valid since mortality of chicks in the summer occurred largely

Table 3. Comparison of the number of tagged juvenile birds killed by hunters by age with the theoretical number that should have been killed, assuming equal vulnerability of all age classes to hunting mortality.

| Date of Hatch or Capture | Total Tagged Juvenile Birds | | Chi-square |
|---|---|---|---|
| | Killed | Theoretical[a] | |
| June 14–30 | 12 | 24.1 | 6.075* |
| July 1–14 | 40 | 36.7 | 0.297 |
| July 15–Aug. 31 | 18 | 9.2 | 8.417* |
| Totals | 70 | 70.0 | 14.789 |

[a] Based on total young tagged.
* $P < 0.05$.

Fig. 1. Composite hatching dates plotted for ptarmigan on the Arctic Peninsula 1961–1964.

prior to 3 weeks of age (Bergerud 1969). Thus, even though both groups had different elapsed time between tagging and shooting, this difference would not affect survival to October—most natural mortality would have occurred prior to October even for birds hatched as late as August 10 (Fig. 1). Fourteen percent of the juveniles in the kill still retained juvenile primary 8 (10,242 birds examined). These birds would have hatched from August nests. However, only 9 of 285 (3 percent) broods hatched in August (Fig. 1).

## DISCUSSION

The seasonal decline of juvenile ptarmigan in the kill may reflect a greater vulnerability of late-hatched young, birds from predominantly second nests hatched after July 7. A corollary is that most young, hatched between June 21 and July 7, may be nearly as adept as adults in evading hunters in October.

This hypothesis was tested by constructing a hypothetical pre-season population and subjecting it to various mortality rates. These should alter the population in accordance with percentages of juveniles and adults observed in the October kill. To avoid changes in the kill composition due to differential age mortality, the analysis was restricted to juvenile:adult ratios before hunting, 72:28, and in the first week's kill, 74:26 (Table 1 and 2). Differential

Table 4. Hypothetical determination of hunting vulnerability of early[a] and late hatched[b] young during first week of hunting season.

| Vulnerability Ratio Early vs. Late Young | Composition of Pre-season Population | | Mortality Rate | Birds Killed Number | Birds Killed Percent |
|---|---|---|---|---|---|
| 1:1 | 619 | Early Young | 8.5 | 53 | 74 |
| | 101 | Late Young | 8.5 | 8 | |
| | 280 | Adults | 7.5 | 21 | 26 |
| 1:2 | 619 | Early Young | 7.5 | 46 | 74 |
| | 101 | Late Young | 15.0 | 15 | |
| | 280 | Adults | 7.5 | 21 | 26 |

[a] Early-hatched June 14–July 7.
[b] Late-hatched July 8–August 10.
[c] Juvenile:adult ratio = 72:28

mortality presumably accounts for this alteration, assuming that it is statistically significant.

In this hypothetical population, late-hatched young probably comprised 14 percent of the juvenile birds. This figure was based on the following data from Bergerud (1969):

1. 18 percent of all broods were hatched after July 7 from 1958 to 1965.
2. The mean number of chicks per brood in August from early- and late-hatched nests was 4.5 and 3.2 from 1961 to 1964.

Using the figure of 14 percent, there would then be, in the population of 1,000 birds, 619 early-hatched young, 101 late-hatched young, and 280 adults.

The hunting harvest during the first week constituted 51 percent of the total kill 1955–64 (Personal files). The estimated 10-year mean seasonal harvest, 1955–64, was 16 percent (Manuel 1966); hence, in the first week of hunting, 82 birds should be removed for a population of 1,000 (0.16 × 0.51); of these 61 should be juveniles and 21 adults (ratio of 74:26).

If we assume that early-hatched young are more vulnerable than adults to hunting,

then we must assume that early- and late-hatched young are equally as vulnerable to hunting, to agree with the juvenile: adult ratio of 74:26 (Table 4). Such an assumption does not seem valid (Table 4); few late-hatched young were killed in the second week of hunting; these small 300–400 g birds were easily killed and probably largely removed from the population by the harvest in the first week of hunting.

If we apply a hunting vulnerability factor of 1:2 for early versus late young (Table 3), then early-hatched juveniles and adults must be nearly equally susceptible to hunting (Table 4). This appears to be a more logical hypothesis than that of equal vulnerability of early- and late-hatched young. The hypothesis of equal vulnerability of early young and adults was supported by a study of willow ptarmigan on Brunette Island (Mercer 1966). On Brunette Island hatching curves in four years, 1961 to 1964, showed that nearly all the broods ($N = 130$) hatched in June; there were no late-hatched young in the population. In these 4 years, the young in August–September represented $60 \pm 3$ (95 percent C.L.) percent of the population ($N = 844$) and in the October kill, largely made in the first week of October, $61 \pm 6$ percent ($N = 213$).

## LITERATURE CITED


Bennett, R. 1951. Some aspects of Missouri quail hunting 1938–48. Missouri Conserv. Comm., Tech. Bull. 2. 31pp.

Bergerud, A. T. 1969. Population dynamics of willow ptarmigan in Newfoundland. (Submitted Oikos.)

———, and D. S. Huxter. 1969. Effects of hunting on willow ptarmigan in Newfoundland. J. Wildl. Mgmt. 33(4):866–870.

———, S. S. Peters, and B. McGrath. 1963. Determining sex and age of willow ptarmigan in Newfoundland. J. Wildl. Mgmt. 27(4): 708–711.

Dorney, R. S., and C. Kabat. 1960. Relation of weather, parasitic disease and hunting to Wisconsin ruffed grouse populations. Wisconsin Conserv. Dept., Tech. Bull. 20. 61pp.

Errington, L., and R. I. Broseth. 1955. Analysis of pheasant age ratios. Trans. N. Am. Wildl. Conf. 20:357–367.

Helminen, M. 1963. Composition of the Finnish populations of capercaillie, *Tetra urogallus*, and black grouse, *Lyrurus tetrix*, in the autumns of 1952–1961, as revealed by a study of wings. Papers on Game Research 23. Pp.1–124.

Kimball, J. W. 1948. Pheasant population characteristics and trends in the Dakotas. Trans. N. Am. Wildl. Conf. 13:291–314.

Maxell, F. 1960. Wildlife management. Annual Rept. of the Dept. of Mines, Agr. and Resources, St. John's, Newfoundland. Pp.79–97.

Mercer, W. E. 1966. Ecology of an island population of Newfoundland willow ptarmigan. M.S. Thesis. Univ. Wisconsin, Madison. 149pp.


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